

UNDULANT FEVER IN THE GOAT IN MALTA

BY

T. ZAMMIT, C.M.G., M.D.

GOVERNMENT ANALYST, PUBLIC HEALTH DEPARTMENT, MALTA

(Received for publication 17 October, 1921)

PLATES I AND II

Undulant fever, which, notwithstanding the decisions of International Boards, is still by many called Mediterranean fever or Malta fever, is, as heretofore, a disease which causes much suffering and anxiety.

Since the year 1905, when it was demonstrated that the infection was caused by the drinking of milk, more especially that of goats, the Public Health Department of Malta has been endeavouring not only to minimise the occurrence of the disease, but to find a way to stamp it out. For this purpose it has been instructing the public as to the prophylactic measures it should follow, and at the same time keeping watch over the milch animals on the Islands.

In the ten years (1894-1903) preceding the appointment in 1904 of the Mediterranean Fever Commission, the average number of cases in the Maltese Islands was Malta 3·2, Gozo 1·9 per 1,000 of estimated mean population per annum.

During the years 1901, 1902 and 1903, among the ships of the British Mediterranean Squadron constantly at Malta, with an average crew of 8,230, there was an average of 28·55 cases per 1,000; whereas from 1897 to 1903, amongst the British Garrison on the Islands, there was an average of 25·6 cases per 1,000 per annum.

The apparently greater rate of infection among the Services, as compared with that of the civil population, may be explained by the fact that in the Services every case of illness comes under the notice of the Medical authorities, whereas in the civil population slight cases pass unnoticed, and other, possibly numerous cases, are either incorrectly reported or are not reported at all. This happened more especially before 1904, when, owing to insufficient knowledge, the fever was incorrectly diagnosed, and sufficient importance was not given to it.

When it was found out that the fever resulted from the drinking of goat's milk, and that the micro-organism causing the infection could be destroyed at a temperature below 100° C., the Maltese Sanitary Authorities at once made it known that the heating to boiling point of fresh milk would free it from infection.

The Naval and Military Authorities were also prompt to take action. Thus in June, 1906, goat's milk was banished from the dietary of the Garrison (*A.M.D. Report* for 1906, Vol. XLVIII, p. 78), while the C.-in-C.'s General Order to the Fleet, dated 4th August, 1906, prohibited the use of unboiled milk (*Navy (Health) Statistical Report* for 1906, p. 119). By these means a disease, the etiology of which had not only baffled the skill of medical men for about a century, but had also affected the efficiency of the Mediterranean Fleet and the Malta Garrison, was arrested; probably a unique case in medical history. The use of fresh milk had no sooner been tabooed in the Services than the number of cases of undulant fever dropped as if by magic, and both the Navy and the Army on this station have since been almost entirely free from it. English people, whose duty compelled them to reside in Malta for some time, obtained a like relief by adopting the simple precaution of boiling the fresh milk or abstaining from it.

Before 1904, few of the employees of the Electric Telegraph Company, the dockyard, etc., or their families, escaped infection; but it is now an exception for a foreign resident, who takes the necessary precautions, to fall a victim to undulant fever. The bulk of the Maltese population, who thought they knew better, have not heeded the caution repeatedly given out by the Sanitary Office as to the danger of using unboiled milk, with the result that there has been hardly any decrease in the number of cases of undulant fever.

THE GOATS

'The Maltese goat is the hardest, the tamest, the best milking goat in existence. It bears a resemblance to the Theban or Egyptian goat, from which it probably originated. Like the Theban goat, it is generally beardless and frequently hornless, has spreading and slightly pendulous ears, though shorter and narrower, has a convex profile though not so marked as in the Theban goat,

has very often a pair of lappets on the throat, and like it is often of a reddish colour, but it has larger hair and the udders are very large, in relation to its remarkable milking qualities. Maltese goats milking at the rate of $5\frac{1}{2}$ litres (about $9\frac{1}{2}$ pints) in twenty-four hours are not uncommon. White haired goats were formerly preferred by goatmen, but it was found that they are less hardy than the reddish or black-haired ones.' (Dr. J. Borg, in 'Malta and Gibraltar,' compiled by Allister Macmillan, p. 237, London, 1915.)

From time immemorial, goats in Malta have been milked at people's doors, and it is impossible by legislation to compel householders to boil their milk, but it has been made unlawful for hotels, restaurants, coffee-houses, etc., to serve other than boiled milk. Such a measure should have helped to educate the people in the matter, but the general public has yet to be convinced that an apparently normal beverage drawn straight from the familiar goat can be productive of a deadly fever.

One must also bear in mind that the conclusions of the Commission have not remained unchallenged; apologists have come forward offering negative evidence in defence of the offending goat. Others, who could see only the financial side of the question, have pleaded the cause of the poor milkman.

The Sanitary Authorities, seeing how their efforts were being thwarted, devised other means to protect the sceptical public. Periodical inspection of goats by trained sanitary officers was instituted, and samples of milk, or blood, were taken. The Widal and the Zammit* tests are applied to the blood or milk respectively on the day of their collection. If the goat is found to react it is sent to the Lazaretto under escort, and is there examined by a veterinary surgeon, who assesses its value as a dry goat. The

* *Widal reaction.* Dilutions of the serum of 1 in 80 and 1 in 100 are made with salt solution. The emulsion of *M. melitensis* consists of one to which formalin has been added. One drop of the emulsion and 1 drop of the diluted serum are mixed. The mixture is placed on one of the $\frac{1}{2}$ -inch spaces ruled with a diamond on a glass slide about a foot long. The slide is rocked to and fro for about a minute and placed in a wet chamber at room temperature. Results are read after about two hours, but the reaction is usually obtained, in a positive case, after one minute's rocking of the slide. Naked-eye appearance is sufficient, though a hand lens is sometimes used. In this way about 100 specimens of blood can be examined in a day.

Zammit reaction for milk. Loopfuls of diluted milk and emulsion of culture are mixed on a slide so as to give resulting dilutions of 1 in 20 or 1 in 40. The mixture is drawn into a capillary tube, which is sealed at both ends and stood on end in sand. The result is read next day, though the reaction is sufficiently clear in a couple of hours, the naked-eye appearance of the precipitate being quite characteristic. In doubtful cases the previous test is applied.

owner has the right of appeal on the question of value. The goat is slaughtered at the Lazaretto. The average annual amount paid as compensation to owners for the destruction of infected goats is about £500. In the estimates for 1921 the sum of £700 is allocated. The average cost of an infected goat in pre-war time was 20s.

It was primarily intended to inspect the twenty thousand odd goats spread over the two islands twice yearly; but the limited special staff available could not cope with the work, and the inspection of goats, sheep and cows is consequently restricted. As the inspections are made periodically only, animals that become infected in the interval remain undetected for some time, and consequently a number of infected goats always exist; hence it is not surprising that undulant fever is still prevalent among the civil population.

The systematic, but limited purification of the herds effectually reduced the disease among the animals, and although the frequent examination of every milch animal, with the consequent slaughter of those found infected, is costly, it should be made continuous if the fever is to be eliminated. A much larger staff should be organised; that available has been unable to inspect yearly more than about six thousand, out of about twenty thousand goats.

According to the reports of the Public Health Department, the number of goats examined and the rate of infection found were as follows :—

TABLE I
Showing the rate of infection with *M. melitensis* of goats in Malta

Year	No. of goats examined	No. infected	Percentage
1907-08	1,203	170	14.1
1908-09	1,099	32	2.9
1909-10	9,924	461	4.6
1910-11	13,372	402	3.0
1911-12	13,756	386	2.8
1912-13	11,453	414	3.6
1913-14	6,896	381	5.9
1914-15	4,965	385	7.7
1915-16	6,630	598	9.0
1916-17	7,768	536	6.9
1917-18	5,921	287	4.8
1918-19	4,613	187	4.0
1919-20	5,690	341	5.9

The infection rate is consequently about 5 per cent., a dangerous percentage, for a single goat may infect hundreds of persons during its milking activity.

Sheep are less liable to infection than goats, probably owing to the smaller size of their udders with a consequent smaller chance of abrasion, but there are no reliable statistics as to the number of sheep infected.

In the light of modern treatment of infective diseases, prophylactic inoculations with a *melitensis* vaccine have been suggested on various occasions. In 1906, Dr. Eyre, one of the members of the Mediterranean Fever Commission, used a vaccine in fifty-one cases; of these, twenty-two received one injection and twenty-nine received two injections of 200-400 million cocci. Two of the cases vaccinated contracted the disease.

Professor M. H. Vincent (1918), of Paris, carried out vaccination experiments on goats and published his results in a paper, in which he claimed to have solved the problem of the *melitensis* infection.

The Maltese Government, wishing to utilize Professor Vincent's vaccine, asked the writer to report on the matter. It was agreed, therefore, to repeat Vincent's experiments as described by him, on a number of local goats. The writer, who was no longer in a position to conduct the experiments himself, had the honour to be entrusted with their supervision.

The Technical staff of the Public Health Department carried out the experiments in a most conscientious manner. They all had long experience, both with the micro-organism and with infected goats, and followed Vincent's directions in all particulars. A full report of the work will eventually be published, so that I will only mention the broad conclusion arrived at, that is, that the bright hopes built on the French savant's paper have been dashed to the ground. The immunisation of the vaccinated animals did not occur, and a minimal dose of virulent culture of *M. melitensis* infected both the experimental animals and the controls.

The question remains therefore, *in statu quo*, and either another vaccine will have to be devised or vigorous direct action be taken to free the island from the fever.

At this point, one cannot allow to go unchallenged an assertion that Professor Vincent made in the above-mentioned paper to the

effect 'that an infected goat recovers spontaneously after a period of time more or less long.' This is a bold assertion, which is intimately connected with the whole prophylactic question of the fever. I do not believe that Professor Vincent is justified in making such an assertion, which is contrary to our experience.

The writer who has a very long experience of goats, both normal and infected with *M. melitensis*, has never known an infected goat to recover. The animal may feed well and look bright, its blood may completely lose its agglutinating power, but a careful post-mortem examination shows, as a rule, the micrococcus lurking in one or another of the glands.

After kidding, a goat, that has for about two years appeared healthy and free from an infection it had previously contracted, yields a milk teeming with *melitensis*.

It is satisfactory to read in the Chief Government Medical Officer's Report for 1918-19, that 'the notified number of cases (three hundred and sixty-three) points again this year to diminished incidence of the disease, with deaths—sixteen—representing a *case mortality* of only 4·4 per cent. This is the smallest on record, and is equal only to a death rate of 7·1 per 100,000.' In the report of 1919-20, however, the disease shows a slight recrudescence (six hundred and nineteen cases with a case mortality of 5·1 per cent.), which reduces the hope for a progressive amelioration.

The civil population, too, can protect itself, by using no milk that is not previously boiled. Were this simple procedure to be strictly followed, the fever would disappear from the civil population as it did from the Navy and Army. As, however, most of the people remain obdurate, or careless, it is our duty to eradicate the disease by vigorously acting against the main cause: by destroying every animal found to be infected.

Goats are not susceptible to a cure, and even were a cure possible, their treatment would, in the happiest event, be long and costly; more costly than the animal itself.

An adequate inspection staff should be provided, and no expense spared. Were this done, I am confident that the fever would disappear from the island in a short time.

REFERENCE

- VINCENT, M. H. (1918). Sur la prophylaxie de la Fièvre de Malte par l'immunisation active des animaux vecteurs du germe. *Comptes Rendus de l'Académie de Science*, Feb.

EXPLANATION OF PLATE I

- Fig. 1. Maltese Goat, presented to the Museum of the Liverpool School of Tropical Medicine by Prof. T. Zammit. Photo by Miss M. Brown.
- Fig. 2. Group of goats, Malta.
- Fig. 3. Maltese Goat, presented to the Museum of the Liverpool School of Tropical Medicine by Prof. T. Zammit. Photo by Miss M. Brown.



FIG. 1



FIG. 2



FIG. 3

EXPLANATION OF PLATE II

- Fig. 1. A milch goat, Malta.
- Fig. 2. Group of goats, Malta.
- Fig. 3. A milch goat, Malta.



FIG. 1



FIG. 2



FIG. 3